Minnesota Department of Education

Grade 5
Science MCA-III Item Sampler
Teacher Guide

Updated September 2, 2016

Purpose of the Item Samplers

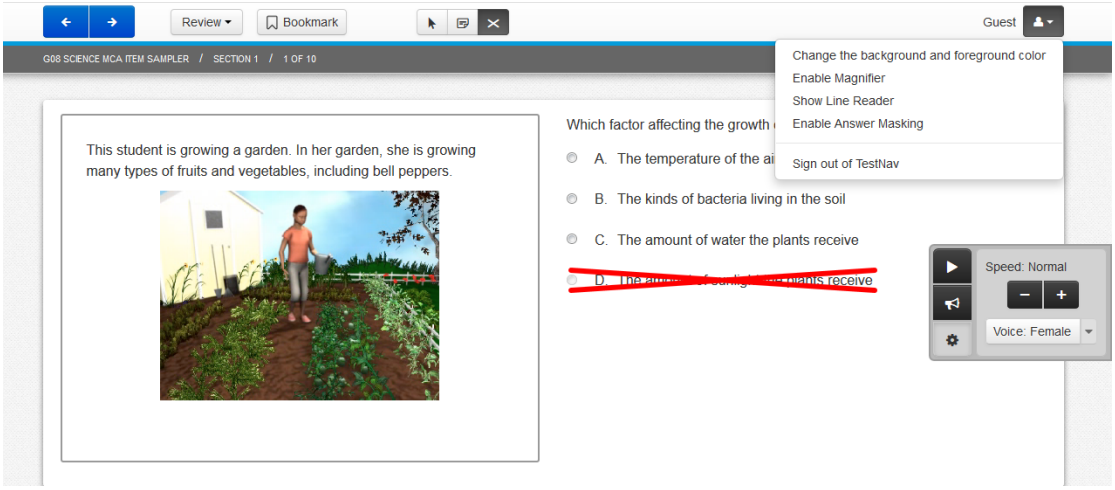
Item Samplers are provided to help teachers and students become familiar with the format and type of content included in the MCAs. Item Samplers contain fewer items than an actual full-length test and are aligned to the Minnesota Academic Standards. They are not suitable for predicting how students will perform on the MCAs.

For more information on the proportions of items aligned to each standard and clarifications on how each standard will be assessed, see the MCA-III Test Specifications for Science (MDE > Districts, Schools and Educators > Statewide Testing > Test Specifications).

The Item Samplers and other testing resources, like the Online MCA Tutorials, can be found on the Pearson Access Next site (http://minnesota.pearsonaccessnext.com).

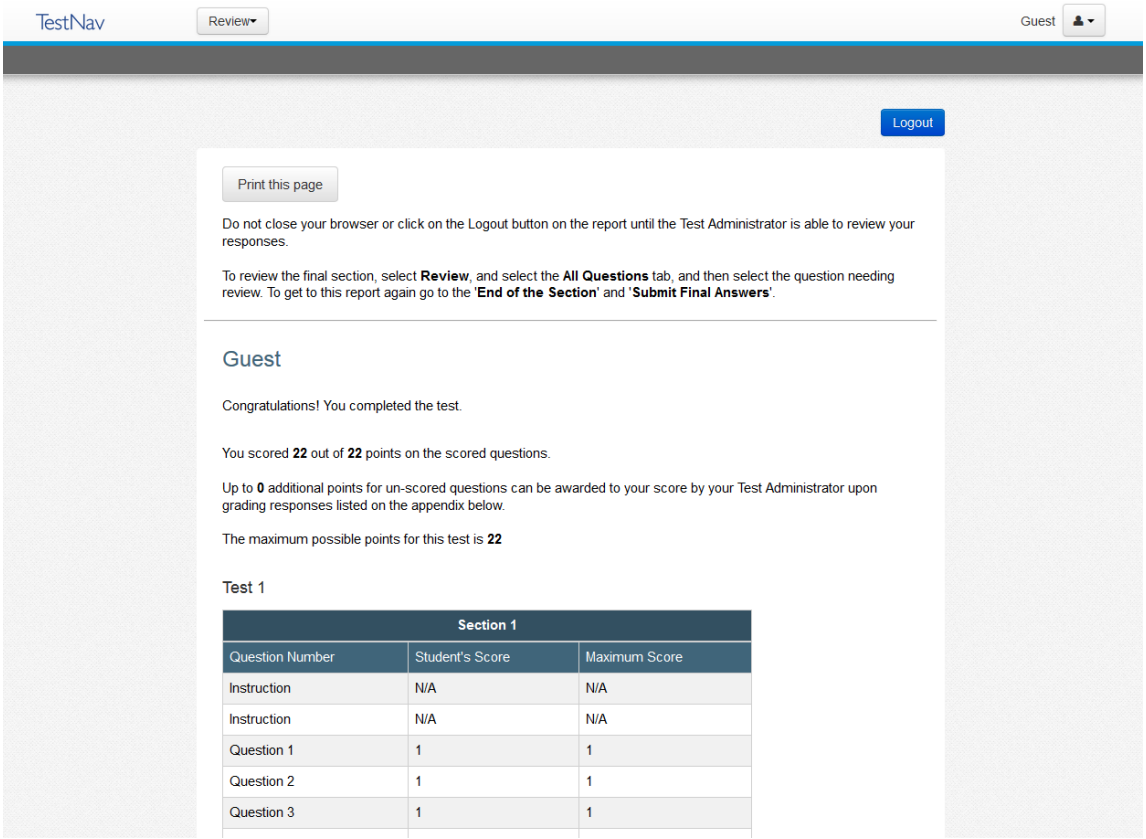
Test Design and Navigation

- The screen is split vertically, with the scene on the left and questions on the right.
- Students are required to answer all questions in a section before they can proceed to the next section.
- A review screen at the end of a section reminds students about unanswered questions and questions they marked for review, and it provides an opportunity to review any questions in that section.
- Text-to-speech (TTS) is available on all items. Accommodated text is available for graphics and tables, but needs to be part of the student's IEP or EL designation
- Online tools include a highlighter, eliminate choice options, line reader, answer option masking, magnifier, notepad, screen contrast, and a calculator if needed.
- All items in the Item Samplers are worth one point.



Score Report

Upon completion of the Item Samplers, a Score Report is displayed. This report can be printed.



Section 1		
Question Number	Student's Score	Maximum Score
Instruction	N/A	N/A
Instruction	N/A	N/A
Question 1	1	1
Question 2	1	1
Question 3	1	1

Teacher Guide

This guide includes the answer keys for all items in the sampler, along with rationales for the answer options. When student performance data is available for an item, the percentages of students answering correctly and incorrectly are shown. Item benchmark alignment and Depth of Knowledge (DOK) level are also provided for each item.

DOK refers to the cognitive demand associated with an item. The level of cognitive demand focuses on the type and level of thinking and reasoning required of the student on a particular item. MCA-III levels of cognitive complexity are based on Norman L. Webb's Depth of Knowledge[1] levels. Although certain verbs, such as "recall," "classify" or "reason," are commonly associated with specific cognitive levels, Webb's DOK levels are not determined by the verbs that describe them, but rather the contexts in which the verbs are used and the depth of thinking required.

[1] Webb, N. L. Alignment of science and mathematics standards and assessments in four states (Research Monograph No. 18). Madison: University of Wisconsin – Madison, National Institute for Science Education, 1999.

DOK 1 (recall) items require the recall of information such as a fact, definition, term or simple science process or procedure.

DOK 2 (skill/concept) items call for the engagement of some mental processing beyond a habitual response, with students required to make some decisions as to how to approach a problem or activity.

DOK 3 (strategic thinking) items require students to reason, plan or use evidence to solve a problem.

The MCA-III Science Test Specifications give a more detailed explanation of DOK levels used in the MCA-III assessments.

If you have further questions concerning the MCA Science Assessments please contact the following MDE staff:

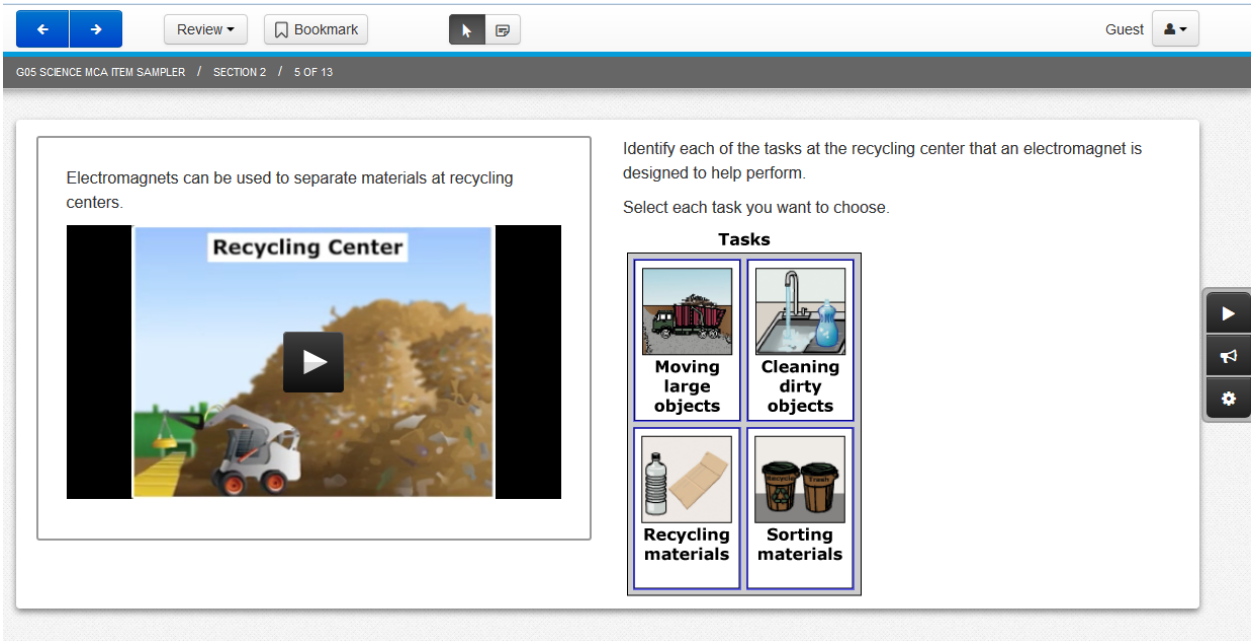
Dawn Cameron, dawn.cameron@state.mn.us, 651-582-8551

Jim Wood, jim.wood@state.mn.us, 651-582-8541

Section 1

Scenario: Electromagnets

Question 1



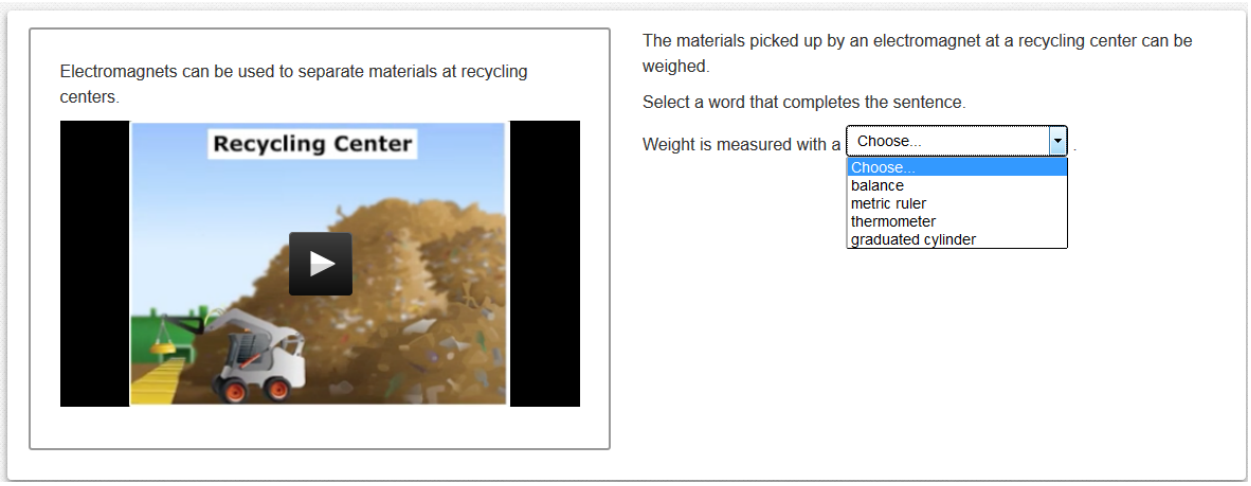
Benchmark: 4.1.2.2.1

Identify and investigate a design solution and describe how it was used to solve an everyday problem. For example: Investigate different varieties of construction tools.

DOK: 2

Answer option	Rationale	Percent of student responses
Correct: Both *Sorting materials* and *Moving large objects are selected*.	These are 2 problems that an electromagnet at the recycling center is designed to solve.	No data available
Incorrect: All other answer combinations	*Cleaning dirty objects* and *Recycling materials* are tasks that do not need to use an electromagnet.	No data available

Question 2



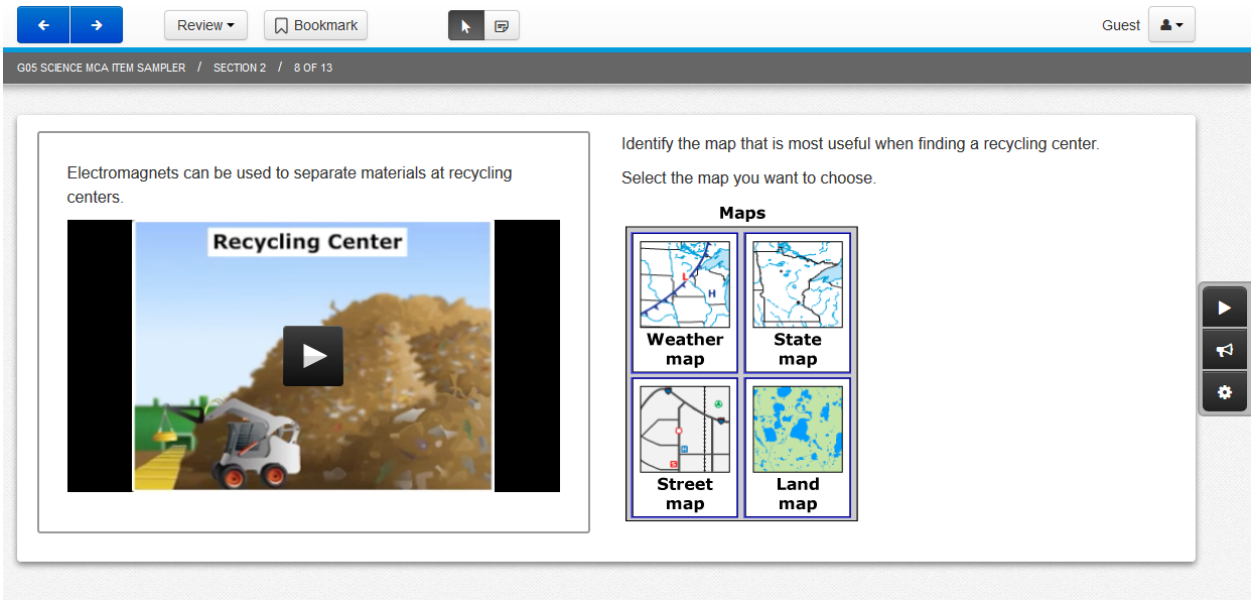
Benchmark: 3.1.3.4.1

> Use tools, including rulers, thermometers, magnifiers and simple balances, to improve observations and keep a record of the observations made.

DOK: 1

Answer option	Rationale	Percent of student responses
Correct: balance	A balance measures weight.	No data available
metric ruler	Metric rulers measure length.	No data available
thermometer	Thermometers measure temperature.	No data available
graduated cylinder	Graduated cylinders measure volumes of liquid.	No data available

Question 3



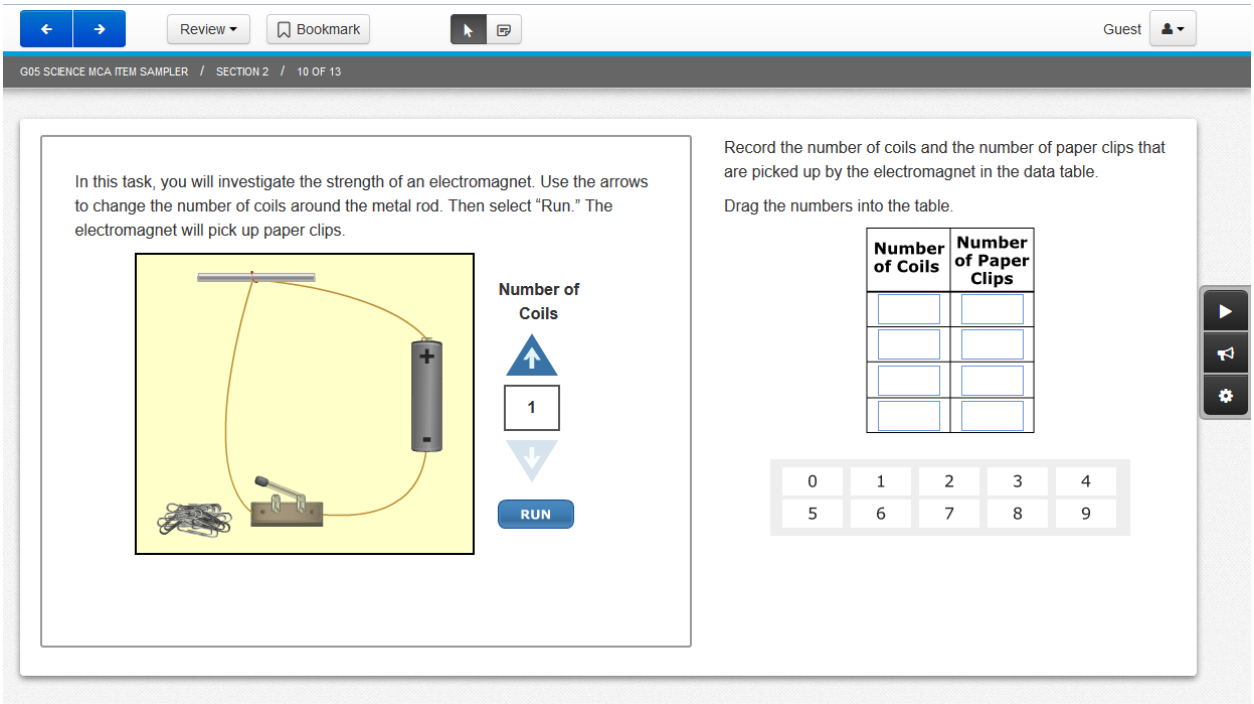
Benchmark: 5.1.3.4.2

> Create and analyze different kinds of maps of the student's community and of Minnesota. For example: Weather maps, city maps, aerial photos, regional maps, or online map resources.

DOK: 1

Answer option	Rationale	Percent of student responses
Correct: *Street map*	A street map is the appropriate map to use to find a recycling center.	No data available
Incorrect: All other responses	Weather, state, and land maps contain information or are on a scale which would not be useful in finding a recycling center.	No data available

Question 4



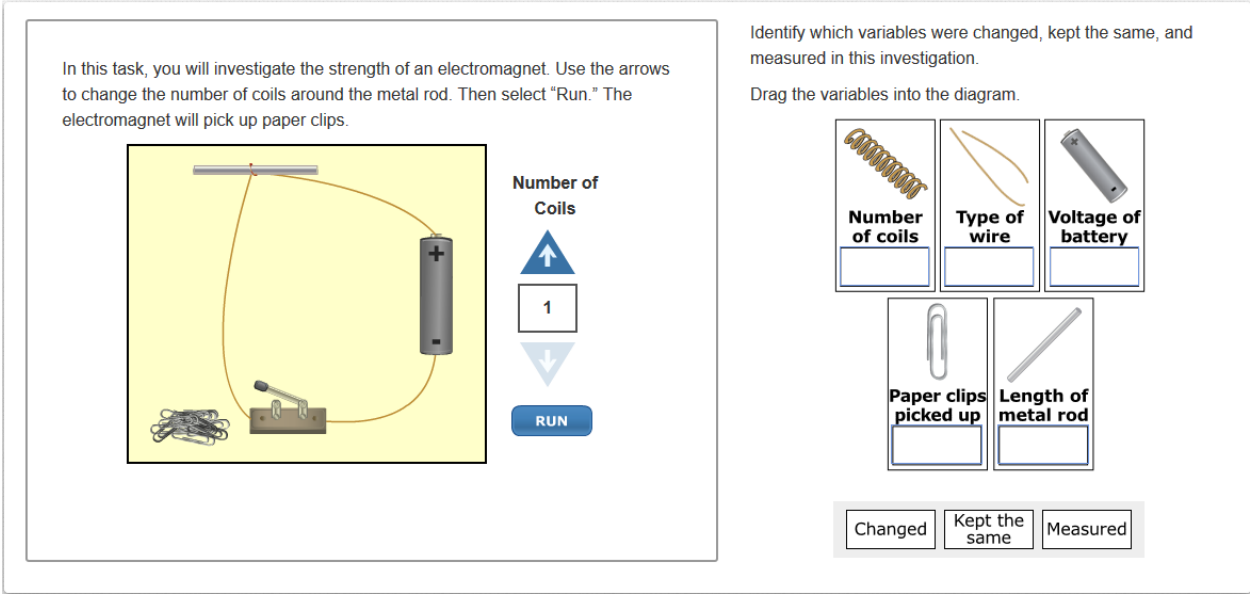
Benchmark: 5.1.1.2.2

Identify and collect relevant evidence, make systematic observations and accurate measurements, and identify variables in a scientific investigation.

DOK: 2

Answer option	Rationale	Percent of student responses
Correct: A data table with the rows in any order: 1 coil – 2 paperclips 2 coils – 4 paperclips 3 coils – 6 paperclips 4 coils – 8 paperclips	The student is directly recording the data in the data table that is generated by running several simulations on the left side of the screen.	No data available
Incorrect: All other responses	Student does not record the variable or results accurately in the table.	No data available

Question 5



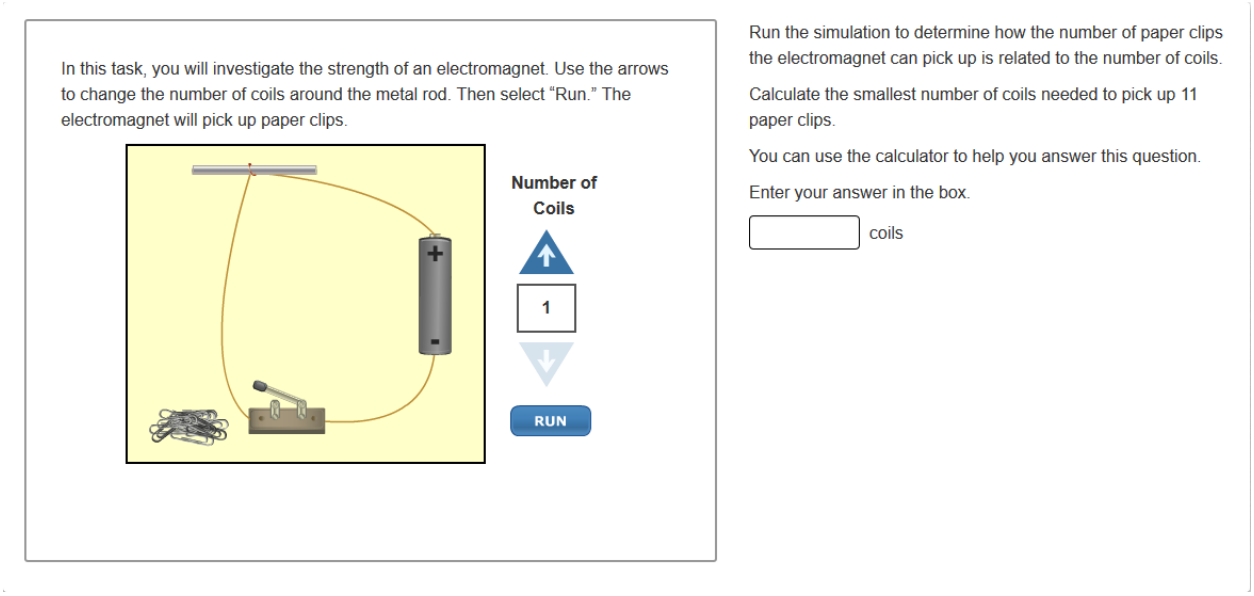
Benchmark: 5.1.1.2.2

Identify and collect relevant evidence, make systematic observations and accurate measurements, and identify variables in a scientific investigation.

DOK: 1

Answer option	Rationale	Percent of student responses
Correct: Changed = *Number of coils*; Kept the same = *Type of wire*, *Voltage of battery*, *Length of metal rod*; Measured = *Paper clips picked up*.	In the simulation, the number of coils is changed by the student which affects the number of paperclips picked up. All other variables are kept the same.	No data available
Incorrect: All other answer combinations	All other answer option combinations do not show an understanding of the variables and controls of the investigation.	No data available

Question 6



Benchmark: 4.2.3.2.3

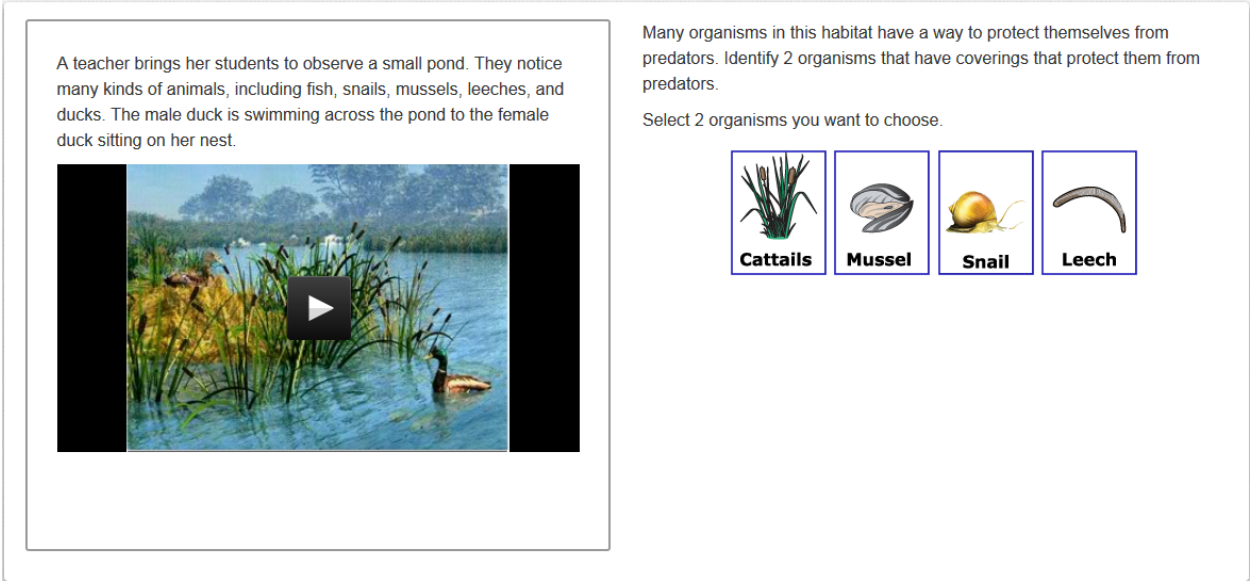
Demonstrate how an electric current can produce a magnetic force. For example: Construct an electromagnet to pick up paperclips.

DOK: 3

Answer option	Rationale	Percent of student responses
Correct: 6	The electromagnet lifts 2 clips per coil and a maximum of 10 clips with 5 coils. Adding a sixth coil will enable the electromagnet to lift up to 12 paper clips. Since 5 coils can lift only up to 10 paper clips, 6 is the smallest number of coils needed to lift 11 paper clips.	No data available
Incorrect: All other responses	The student does not understand the relationship between the number of coils and the number of paperclips that can be picked up.	No data available

Scenario: Pond History

Question 7



Benchmark: 3.4.1.1.1

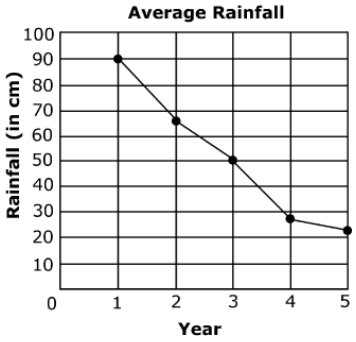
> Compare how the different structures of plants and animals serve various functions of growth, survival and reproduction. For example: Skeletons in animals and stems in plants provide strength and stability.

DOK: 1

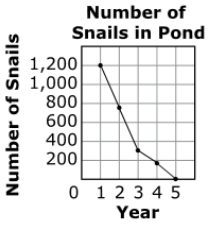
Answer option	Rationale	Percent of student responses
Correct: *Mussel* and *Snail*	Mussels and snails have hard outer coverings that protect them from predators.	78%
Incorrect: All other answer combinations	Cattails and leeches do not have protective coverings.	22%

Question 8

Five years later, the teacher brings another group of students to the same spot. Many changes have taken place. The area has dried up, and the pond is now gone. The teacher explains that the area has had little rain. The teacher shows this graph to the students.



A type of snail is extinct in this area. Which statement explains why this may have happened?



- A. It reproduced too rapidly.
- B. It could not live near plants.
- C. It could not adapt to new conditions.
- D. It was eaten by too many consumers.

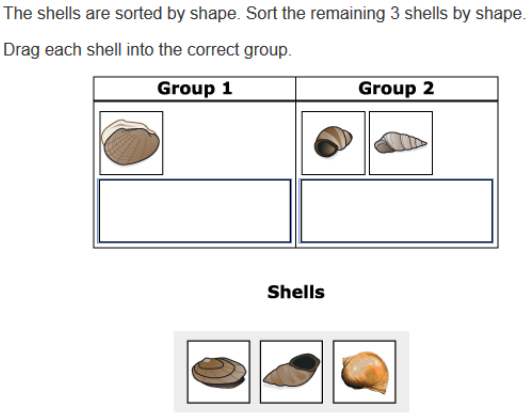
Benchmark: 5.4.2.1.2

Explain what would happen to a system such as a wetland, prairie or garden if one of its parts were changed. For example: Investigate how road salt runoff affects plants, insects and other parts of an ecosystem. Another example: Investigate how an invasive species changes an ecosystem.

DOK: 2

Answer option	Rationale	Percent of student responses
A	The loss of habitat caused by a decrease in rainfall, not a rapid increase in population, causes a local extinction.	8%
B	The loss of habitat caused by a decrease in rainfall is the issue, not increased competition by living near plants.	4%
Correct: C	Inability to adapt to new conditions leads to extinction.	73%
D	Student may think that predation (rather than ability to adapt) caused the snails to die out.	15%

Question 9



Benchmark: 3.4.1.1.2

Identify common groups of plants and animals using observable physical characteristics, structures and behaviors. For example: Sort animals into groups such as mammals and amphibians based on physical characteristics. Another example: Sort and identify common Minnesota trees based on leaf/needle characteristics.

DOK: 1

Answer option	Rationale	Percent of student responses
Correct: The bivalve organism (left) goes in Group 1. The two gastropod organisms (middle and right) go in Group 2.	Student is able to sort shells based on physical characteristics.	76%
Incorrect: All other answer combinations	Student response shows little or no understanding of ways to classify organisms based on physical characteristics.	24%

Scenario: Snow Cave

Question 10

The students and their teacher are making a pile of snow and then digging it out to make a snow cave. The cave will be used for some investigations. The students place 1 box inside the cave and 1 box outside the cave. Both boxes are placed upside down. A thermometer is placed on each box.

The air temperature is −2 degrees Celsius (28 degrees Fahrenheit). Which statement correctly describes what happens to snow at this temperature?

- A. Snow starts to melt.
- B. Snow remains frozen.
- C. Snow changes to steam.
- D. Snow melts and then freezes again.

Benchmark: 4.2.1.2.2

Describe how the states of matter change as a result of heating and cooling.

DOK: 2

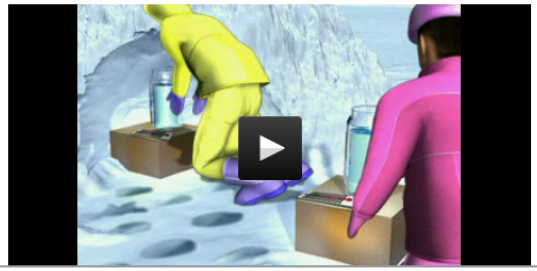
Answer option	Rationale	Percent of student responses
A	Melting will not occur at this cold temperature.	15%
Correct: B	Snow remains frozen at this cold temperature.	68%
C	Steam will not be produced at this temperature.	3%
D	Snow is already frozen and will not melt at this temperature.	14%

Question 11

One cardboard box is inside the cave and the other is outside the cave. Students place the thermometers and bottles filled with hot water on the cardboard boxes. Later, the students check the air temperatures on their thermometers. The air temperature readings are shown in the table.

Air Temperature

	Inside	Outside
Before	−2°C (28°F)	−2°C (28°F)
After	5°C (41°F)	−2°C (28°F)

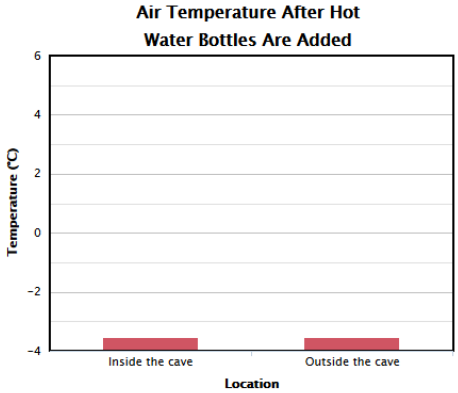


Make a graph of the air temperatures inside and outside of the cave 30 minutes after the hot water bottles are added.

Drag the top of each bar to the correct height.

Air Temperature

	Inside	Outside
Before	−2°C (28°F)	−2°C (28°F)
After	5°C (41°F)	−2°C (28°F)



Benchmark: 5.1.3.4.1

Use appropriate tools and techniques in gathering, analyzing and interpreting data. For example: Spring scale, metric measurements, tables, mean/median/range, spreadsheets, and appropriate graphs

DOK: 1

Answer option	Rationale	Percent of student responses
Correct: The left bar is at 5 and the right bar is at -2.	The student is able to graph the appropriate data to represent the temperature inside the cave and outside the cave after 30 minutes.	71%
Incorrect: All other responses	The student does not graph the data correctly.	29%

Question 12

Students fill 4 containers with equal amounts of water and seal them. Two of the containers are placed in mittens. One container with a mitten and one container without a mitten are placed in the snow cave. One container with a mitten and one container without a mitten are left outside the snow cave. One hour later, the container left outside without a mitten is frozen. The other containers still contain liquid water.

There is ice in the container that was left outside without a mitten. If the air temperature increases to 10 degrees Celsius (50 degrees Fahrenheit), what will happen to the ice?

- A. It will lose mass.
- B. It will get heavier.
- C. It will start to boil.
- D. It will change into a liquid.

Benchmark: 4.2.1.2.2

Describe how the states of matter change as a result of heating and cooling.

DOK: 1

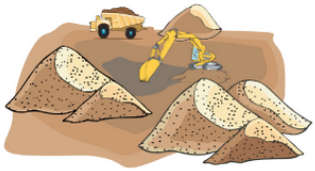
Answer option	Rationale	Percent of student responses
A	Student thinks that a change in phase from solid to liquid will decrease the water's mass.	9%
B	Student thinks that a change in phase from solid to liquid will increase the water's weight.	7%
C	Student thinks the temperature is high enough to cause boiling.	3%
Correct: D	The solid water will melt and become a liquid at this temperature. This temperature will facilitate a complete change from a solid to liquid but not a gas.	81%

Section 2

Scenario: Mining

Question 13

Mining is a common practice used to obtain different resources. Many of the resources obtained by mining go through different processes before they are used by people.



Iron is found in the mineral hematite. What is done to the mineral hematite to separate out the iron?

- A. Hematite is processed.
- B. Hematite is kept in one piece.
- C. Hematite is found in more than one mine.
- D. Hematite is sold for a large amount of money.

Benchmark: 5.3.4.1.2

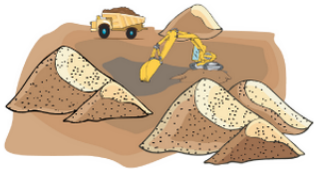
Give examples of how mineral and energy resources are obtained and processed and how that processing modifies their properties to make them more useful. For example: Iron ore, biofuels, or coal.

DOK: 2

Answer option	Rationale	Percent of student responses
Correct: A	Minerals must be processed to become useful resources.	66%
B	To remove the iron from hematite, the hematite cannot be kept in one piece.	11%
C	A single mine can support hematite processing for iron so more than one mine is not necessary.	16%
D	Hematite need not be sold before it is processed.	7%

Question 14

Mining is a common practice used to obtain different resources. Many of the resources obtained by mining go through different processes before they are used by people.



People use mined natural resources to supply energy to their homes. Which resource is a source of non-renewable energy?

- A. Coal
- B. Solar
- C. Water
- D. Wind

Benchmark: 5.3.4.1.1

Identify renewable and non-renewable energy and material resources that are found in Minnesota and describe how they are used. For example: Water, iron ore, granite, sand and gravel, wind and forests.

DOK: 2

Answer option	Rationale	Percent of student responses
Correct: A	Coal is a non-renewable resource.	71%
B	Solar energy is a renewable resource.	12%
C	Water is a renewable resource.	8%
D	Wind is a renewable resource.	9%

Question 15

A gravel pit is a location where gravel is mined. Different minerals can be found in a gravel pit.

Mineral	Streak Test	Luster	Hardness	Color
Hematite	Red	Metallic	6	Silver
Bauxite	Light brown	Non-metallic	3	Brown
Gypsum	White	Non-metallic	2	White

A lower hardness number means a softer mineral.

A student tests an unknown mineral. This unknown mineral can be scratched by hematite. What conclusion can the student make about the mineral based on this test?

- A. The mineral is bauxite.
- B. The mineral is gypsum.
- C. The mineral is softer than hematite.
- D. The mineral is harder than hematite.

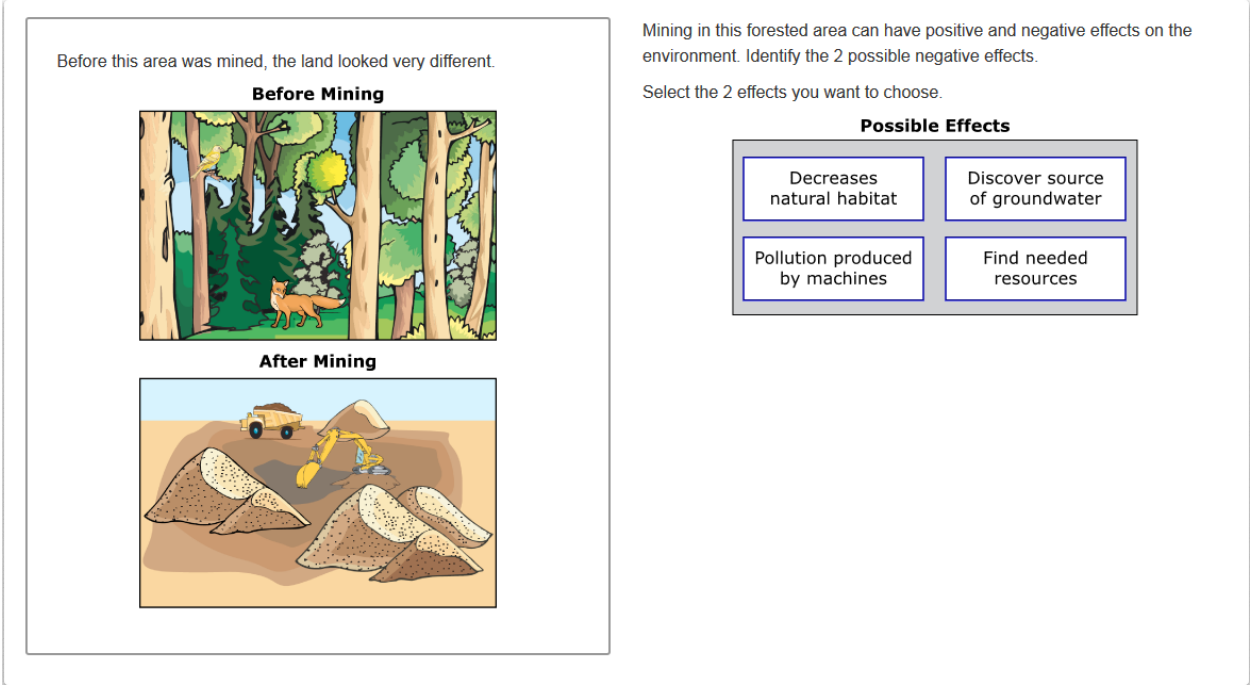
Benchmark: 4.3.1.3.2

Describe and classify minerals based on their physical properties. For example: Streak, luster, hardness, reaction to vinegar.

DOK: 2

Answer option	Rationale	Percent of student responses
A	While the mineral can be bauxite, there is not enough evidence to prove that it isn't gypsum.	6%
B	While the mineral can be gypsum, there is not enough evidence to prove that it isn't bauxite.	11%
Correct: C	Because the mineral could be scratched by hematite, the only claim that can be made is that the mineral is softer than hematite.	69%
D	If the mineral is scratched by another mineral with a known hardness of 6, then this unknown mineral's hardness cannot be greater than 6.	15%

Question 16



Benchmark: 5.4.4.1.1

Give examples of beneficial and harmful human interaction with natural systems. For example: Recreation, pollution, or wildlife management.

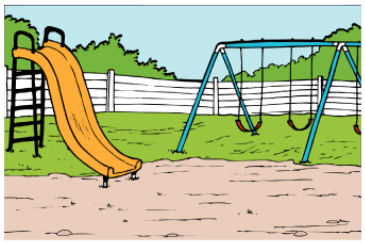
DOK: 2

Answer option	Rationale	Percent of student responses
Correct: *Decreased natural habitat* and *Pollution produced by machines*	The student understands that the destruction of wildlife's natural habitat and pollution from machines are negative effects of mining.	77%
Incorrect: All other answer combinations	*Discover source of groundwater* and *Find needed resources* are not negative effects of mining.	23%

Question 17

After the mining is finished, the land can be used for recreation.

Playground



Students go down the slide. Identify each force that affects the students' motion on the slide.

Select each force you want to choose.

Forces

- ☐ Electricity
- ☐ Friction
- ☐ Gravity
- ☐ Magnetism

Benchmark: 5.2.2.1.2

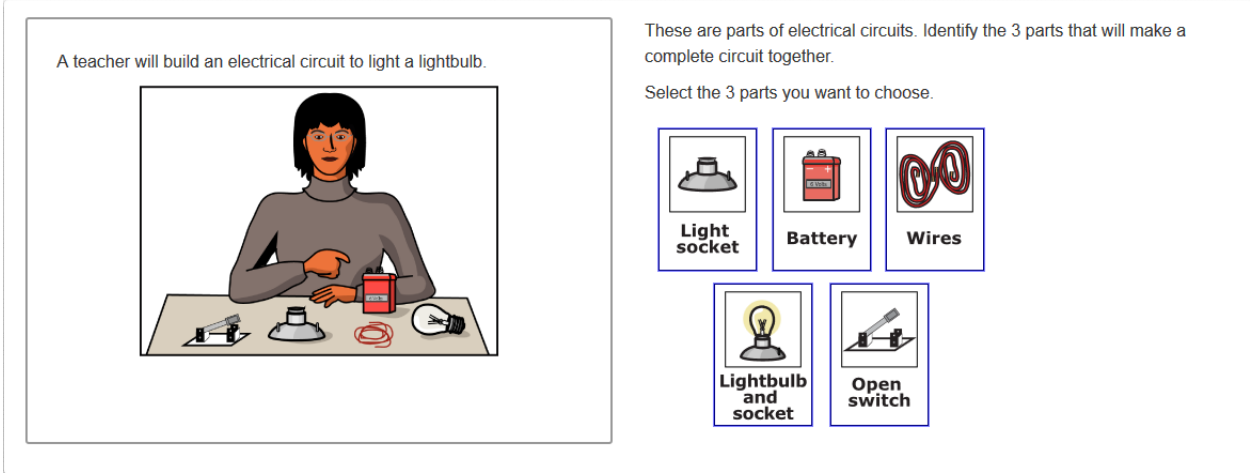
Identify the force that starts something moving or changes its speed or direction of motion. For example: Friction slows down a moving skateboard.

DOK: 1

Answer option	Rationale	Percent of student responses
Correct: *Friction* and *Gravity*	The student understands that gravity and friction are forces that affect the speed and direction of motion when a child is on a slide.	51%
Incorrect: All other answer combinations	*Electricity* and *Magnetism* are not forces that would affect a child's motion on a slide.	49%

Scenario: Energy

Question 18



Benchmark: 4.2.3.2.2

Construct a simple electrical circuit using wires, batteries, and lightbulbs.

DOK: 2

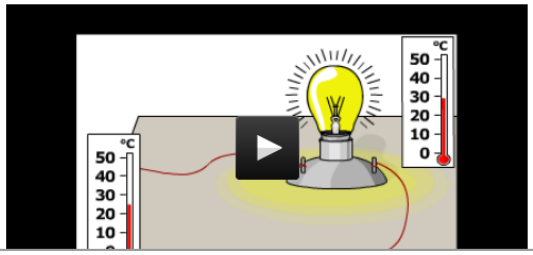
Answer option	Rationale	Percent of student responses
Correct: *Lightbulb and socket*, *Wires*, and *Battery*	The student understands that to have a compete circuit you need an energy source, wires, and socket with a lightbulb.	76%
Incorrect: All other responses	While an *Open switch* and *Light socket* can be parts of a circuit, they will not form a completed circuit.	24%

Question 19

When a lightbulb is lit, it represents an energy source that produces light and heat. Thermometers are used to measure heat energy. When the lightbulb is lit, the students observe the thermometers and record their observations in their journals.

Time and Temperature

Time (in minutes)	Temperature Close to Lightbulb (in °C)	Temperature Away from Lightbulb (in °C)
0	25	25
2	27	25
4	29	25



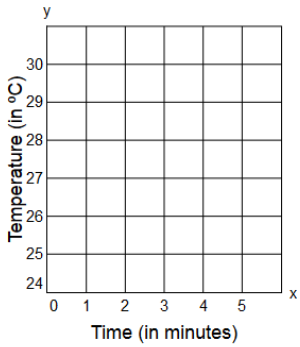
The data in the table show the temperature away from the lightbulb and the time in minutes. Make a graph of the data.

Time and Temperature

Time (in minutes)	Temperature Close to Lightbulb (in °C)	Temperature Away from Lightbulb (in °C)
0	25	25
2	27	25
4	29	25

Select a location on the graph to plot each data point from the table.

Temperature Away from Lightbulb



Benchmark: 5.1.3.4.1

Use appropriate tools and techniques in gathering, analyzing and interpreting data. For example: Spring scale, metric measurements, tables, mean/median/range, spreadsheets, and appropriate graphs

DOK: 1

Answer option	Rationale	Percent of student responses
Correct: Student plots the points 0,25; 2,25; 4,25.	The student identifies the data from the table and correctly plots the data for the *Temperature Away from Lightbulb*.	34%
Incorrect: All other responses	The student plots the data for the *Temperature Close to Lightbulb* or makes an error plotting the data.	66%

Question 20

The Sun also produces light and heat. Students want to know how an energy source like the Sun affects the amount of water that evaporates. They place equal amounts of water in 3 different locations. They measure the temperature in each location and record the data in their journals.

Temperature in Three Locations

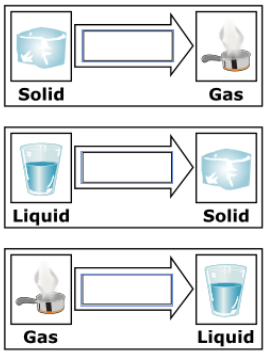
Location	Air Temperature (in °C)
Window	30
Room	23
Refrigerator	5

What causes the phase change in each of the pictures?

Drag the words into the diagram.

Cooling **Heating**

Phase Changes



Benchmark: 4.2.1.2.2

Describe how the states of matter change as a result of heating and cooling.

DOK: 2

Answer option	Rationale	Percent of student responses
Correct: The order from top to bottom: *Heating*, *Cooling*, and *Cooling*	The student understands that: • Heating is needed to change water from a solid to a gas. • Cooling is needed to change water from a liquid to a solid. • Cooling is needed to change water from a gas to a liquid.	73%
Incorrect: All other answer combinations	The student does not understand how heating and cooling affect phase changes.	27%

Question 21

At the end of the day, the students measure the amount of water left in each pan. They record the data in their journals.

Temperature's Effect on Evaporation

Location	Water at Start (in mL)	Air Temperature (in °C)	Water at End (in mL)
Window	10	30	5
Room	10	23	7
Refrigerator	10	5	9

What happens when water evaporates?

A. The water gets hotter.

B. The water changes color.

C. The water changes into a gas.

D. The water changes into a solid.

Benchmark: 4.2.1.2.2

Describe how the states of matter change as a result of heating and cooling.

DOK: 1

Answer option	Rationale	Percent of student responses
A	The temperature of the water does not change during evaporation.	8%
B	The color of water does not change during a change of state.	2%
Correct: C	Evaporation is a change of state from a liquid to a gas.	86%
D	Freezing is a change of state from a liquid to a solid.	4%